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ABSTRACT

The document first provides a review of recent literature on sex differences in mathematics achievement. From national and international studies, achievement trends across the grades, how achievement varies according to the skills or knowledge assessed, and the mathematical ability of high-ability students are each summarized. Then studies specific to Hawaii are considered. The second section considers the influence of sex roles on achievement, peer-group influences, and cultural influences as reported in national and international studies and in studies conducted in Hawaii. Next, research and measurement issues are noted, followed by a report on a study of sex differences among four ethnic groups in Hawaii: Caucasians, Filipinos, Hawaiians, and Japanese. Data from mathematics subtests of the annual statewide administration of the Stanford Achievement Test from 1982-83 and 1983-84 for grades 4, 6, 8, and 10 are analyzed. Girls were found to have higher mathematics achievement levels than boys, with differences increasing as grade level increased. Sex differences varied by ethnic group, with Japanese-American students found to be particularly high achievers. Boys scored highest on tests of mathematics reasoning, while girls scored highest on computation. Eleven tables are included in the document, plus references. (MNS)

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# The Superiority of Girls Over Boys in Mathematics Achievement in Hawaii

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# The Superiority of Girls Over Boys in Mathematics Achievement in Hawaii

## INTRODUCTION

Most studies of sex differences in mathematics achievement show boys surpassing girls. Research shows the gap between boys and girls varying by country, grade level, skill assessed, and ability level. Few studies, however, have considered the effects of ethnicity on patterns of sex differences. In this paper, we summarize some of the recent literature on sex differences in mathematics achievement, describe patterns of sex differences in mathematics achievement among four ethnic groups in Hawaii, and discuss how the Hawaii findings are similar to and different from findings reported in previous studies of sex differences in mathematics achievement.

## Studies of Sex Differences in Mathematics Achievement

### National and International Studies

#### Achievement Trends Across Grades

A widely accepted conclusion about mathematics achievement trends across grades is that grade school girls often (but not always) outperform grade school boys, adolescent boys usually outperform adolescent girls, and the gap between boys and girls increases as grade levels increase. Studies of mathematics achievement trends across grades, however, do not show uniform

results, and reviews of the literature (Fennema, 1974; Maccoby & Jacklin, 1974; Meece, Parsons, Kaczala, Goff, & Futterman, 1982; Sherman, 1978) give differing summaries of these trends. We conclude that the most accurate and generalizeable summary of mathematics achievement trends across grades is simply that most studies show boys' achievement levels surpassing girls' levels at some point in their schooling, and the point when boys surpass girls varies considerably from sample to sample.

Here are some of the recent findings of American studies of sex differences in mathematics achievement. Plake, Loyd, and Hoover (1978) tested students in Grades 3, 6, and 8 on mathematics problem-solving and mathematics concepts tests and found girls slightly outperforming boys at all three grade levels. Hilton and Berglund (1974) tested a cohort of 1,739 students at Grades 5, 7, 9, and 11 and found similar achievement levels of boys and girls at Grade 5, with boys significantly outperforming girls (among a college preparation group) at Grades 7, 9, and 11. Using the $d$ statistic to show differences (where $d$ = the boys' mean subtracted from the girls' mean with the result divided by the average standard deviation of the sexes), the differences ranged from .16 in Grade 5 (favoring girls) to -.36 in Grade 11 (favoring boys). Lewis and Hoover (1983) examined the Grade 4, 6, 8, and 11 mathematics achievement test scores of 557 college freshmen and found boys and girls at about the same level in Grade 4, with boys outachieving girls at Grades 6, 8, and 11 (only the

11th-grade difference was statistically significant). Ds ranged from .13, Grade 4 (favoring girls) to -.35, Grade 10 (favoring boys). In Hyde's (1981) meta-analysis of studies discussed in Maccoby and Jacklin's (1974) literature review of sex differences, the median d = -.43 (favoring boys). Backman (1972) and Flanagan (1982) reported results that showed boys improved more than girls in mathematics achievement as they grew older and Benbow and Stanley (1982) reported that high ability boys improved more than high ability girls from a junior- to a senior-high school administration of the Scholastic Aptitude Test. For Benbow and Stanley's junior-high sample of high ability children, d = -.61 (favoring boys); for their follow-up sample of graduating seniors, d = -.63. Results from the National Assessment of Education Progress (NAEP) show that 17-year-old males have higher mean scores than 17-year-old females in all NAEP mathematics tests (NAEP, 1983).

Here are some findings about non-American and international studies. Husen's (1967) report showed boys outperforming girls at the junior- and senior-high-school levels in 11 countries; girls of some countries, however, outperformed boys of other countries. Within-country results in the Husen study showed greater differences between senior-high boys and girls than between junior-high boys and girls. D statistics (averaged across countries) ranged from -.17 (favoring boys) for 13-year-old children to -.43 for students who were (a) in their

final year of secondary school before entering the university and (b) taking mathematics as a complementary course. Stigler, Lee, Lucker, and Stevenson (1982) reported no statistically significant differences in mathematics achievement between sexes in samples of first- and fifth-graders in Japan, Taiwan, and the United States. In Grade 5, $\underline{d}$ = .09 in Taiwan (Taiwanese girls outperformed boys), $\underline{d}$ = .07 in Japan (Japanese girls outperformed boys), and in the United States, $\underline{d}$ = -.19 (American boys outperformed girls). A preliminary report of mathematics achievement in Japan showed no statistically significant differences between sexes in one intermediate-level grade and one high school-level grade (W. Cummings, personal communication, February 11, 1985). A multi-national study of 10- and 14-year-olds in seven countries showed no statistically significant differences between boys and girls on standardized mathematics achievement tests (Peck, 1971).

How Achievement Varies According to the Skills or Knowledge Assessed

Boys have outperformed girls on assessments of some mathematical skills or knowledge and girls have outperformed boys on others. Some literature reviews have discussed how boys usually have outperformed girls on tests of mathematics reasoning (Meece et al, 1982) and how girls often have outperformed boys in computation (Meece et al, 1982; Sherman, 1978). A nation-wide study by the National Assessment of Educational Progress (NAEP) showed females at ages 9 and 13

slightly ahead of males in tests on numbers and numeration and (at age 13 only) in tests on consumer math; 9- and 13-year-old boys were ahead of girls on geometry tests (National Center for Education Statistics, 1976). NAEP results in 1978 and 1982 showed girls outperforming boys in mathematics knowledge and skills but boys outscored girls in mathematics understanding and applications (NAEP, 1983). The 1960 Project Talent results showed girls outperforming boys in mathematics computation in Grades 9-12 and in a subtest simply called "mathematics," Grade 9 only, but boys outperformed girls in quantitative reasoning at all four grades and in "mathematics" at Grades 10-12 (Flanagan, 1982). An international study of junior-high- and senior-high-level students in 11 countries (Husen, 1967) showed boys generally outperformed girls in mathematics with fewer statistically significant differences in mathematics computation than in verbal mathematics problems.

The Mathematics Ability of High-Ability Students

Recent evidence indicates that sex differences in mathematics ability may be greater among high ability students than among students of average ability (Benbow & Stanley, 1980, 1983). Benbow and Stanley found the greatest disparity between boys and girls in the highest-scoring group of seventh-grade high ability students who were given the Scholastic Aptitude Test: among seventh graders who scored greater than 700 (estimated at 1 out of 10,000 in the general population), the

ratio of boys to girls was 13:1. In a longitudinal study, Hilton and Berglund (1974) reported statistically significant sex differences at Grades 7, 9, and 11 for students on a college preparation track and significant differences only at Grade 11 for students in a non-college preparation group. Lewis and Hoover's (1983) report of students above the 72nd precentile shows sex differences in mathematics achievement favoring boys and suggests that sex differences among lower-ability students favor girls in Grades 4, 6, and 8.

## Studies in Hawaii

We have identified six studies reporting on sex differences in Hawaii. These studies show that girls may do better in computation than on mathematics reasoning, and in contrast to mainland-U.S. findings, girls tend to show higher mathematics achievement levels than boys.

Here are brief summaries of the studies we identified. Marshall (1927) compared Japanese boys' and girls' and Chinese boys' and girls' Stanford Achievement Test mean scores. In about half the eight age groups (ages 9-16) studied, Japanese girls outperformed Japanese boys in computation; Chinese girls in six of the eight age groups outperformed Chinese boys in computation. In arithmetic reasoning, the only girls to outperform boys were Chinese girls at age 10. Stewart, Dole, and Harris (1967) examined Hawaii 10th- and 12th-grade boys' and girls' results on three mathematics achievement subtests and categorized the data by ethnicity. For the four largest

ethnic groups in the state (Caucasian, Filipino, Hawaiian, and Japanese), Grade 10 results show 8 of the 12 comparisons (three subtests X four ethnic groups) favoring girls (Caucasians = 3, Filipinos = 0, Hawaiians = 2, and Japanese = 3). For Grade 12, six of the 12 comparisons favored girls (Caucasians = 1, Filipinos = 1, Hawaiians = 3, and Japanese = 3). Girls were more likely to outperform boys on computation than on mathematics reasoning. In a study of high school students in an economically depressed area of Hawaii, Holmes (1968) found "no meaningful differences between boys and girls in mathematics achievement or achievement efficiency" (p. 104). A review of 1980-81 public school achievement test data (Kamehameha Schools/Bishop Estate, 1983) showed girls of Hawaiian descent with higher mathematics achievement levels than boys of Hawaiian descent at Grades 4, 6, 8, and 10.

Brenner (1984a, 1984b) examined the mathematics achievement of children in a private Honolulu school where most children are of Hawaiian descent. Brenner's findings tentatively show that the cultural compatibility of reading curricula may influence sex differences in mathematics achievement. In analyses of 1975 and 1977 data, among second- and third-grade children attending classes with a culturally compatible reading curriculum, boys had higher achievement levels in four out of a total of six comparisons; among students with a standard curriculum, girls outperformed boys in four out of four comparisons. In analyses of 1984 data for students instructed

with the same culturally compatible reading curriculum, 15 boy-girl comparisons (Grades K-3) were made. Of the 15 comparisons, 8 favored boys, 4 favored girls, and 3 showed ties between boys and girls.

## Studies of Socio-cultural Influences on Achievement

Theories about biological reasons for sex differences in achievement are plentiful. Benbow and Stanley, (1980, 1982, 1983), for example, provided evidence supporting genetic differences in mathematics ability. Socio-cultural reasons, however, are more widely accepted than biological reasons (Humphreys, Fleishman, & Lin, 1977; Meece et al, 1982; Sherman, 1978); therefore, this review will focus on socio-cultural influences. Literature on socio-cultural influences may be categorized into literature on (a) sex-role influences, (b) peer-group influences, and (c) cultural and ethnic-group influences.

### National and International Studies

#### The Influence of Sex Roles on Achievement

Literature on sex differences in mathematics achievement has indicated that sex role expectations and gender identity may considerably influence sex differences in mathematics achievement. The stereotypical American opinion about sex differences is that males outperform females in mathematics (Sherman, 1978). Dwyer (1974) found that sex differences in Caucasian children (Grades 2, 4, 6, 8, 10, and 12) were more

closely related to sex roles than the children's biological sex, their preference for masculine or feminine roles, or their liking of arithmetic. Dwyer found that students' perception of mathematics as a sex-appropriate activity accounted for 5.97% of the variance in achievement test scores and gender itself accounted for only .76% of the variance. Meece et al (1982) found that men and women (a) had attitudes and behaviors that may have created sex differences in children's achievement (see also Sherman, 1978), (b) expected different achievement levels from boys than from girls, and (c) encouraged children's activities that influence sex differences.

Peer-Group Influences on Achievement

Peer values have a strong influence on student achievement. Coleman (1960) reported that high ability students were more likely to achieve when they were rewarded by their peers for high achievement. Students' high-school popularity tended to have a depressing effect on general achievement because achievement was not often associated with high status (Coleman, 1961). In a review of the literature, Anderson (1982) concluded that peer-group influences varied according to the "home values of the students as a group" (p. 402).

Cultural Influences on Achievement

In nearly all studies of sex differences in achievement, no consideration is given to cultural and ethnic influences on achievement. This omission may account for differing

conclusions about achievement trends. In his summary of an international study of mathematics achievement, Husen (1967) concludes, "It would seem that there are possibly forces operating differently from country to country to produce differences of responses of pupils of the two sexes to mathematical problems" (p. 242). Schratz (1978) reported results showing no statistically significant differences between Black, Caucasian, or Hispanic pre-adolescent boys and girls but found significant differences favoring Hispanic adolescent girls over Hispanic adolescent boys. Even in the pre-adolescent group, d = .35 (favoring Hispanic girls over Hispanic boys). Black adolescent boys and girls performed about the same, while d for Caucasians = -.46 (not a statistically significant difference). All the children Schratz studied were below the 35th percentile of the national norm group.

## Studies in Hawaii

### The Influence of Sex Roles on Achievement

The influence of women as role models in Hawaii on children's expectations and achievement may be considerable. In Werner and Smith's (1976) comprehensive study on Kauai, they found that mothers were better educated and more influential role models than fathers of high-achieving daughters. Because of their roles in the Hawaii workplace, women may be influential models for girls: in 1980, 57.7% of all women over 16 were employed, the fourth highest percentage in the nation

(Department of Planning and Economic Development, 1982). Kitano (1976) reported how second-generation Japanese-Americans were encouraged to become public school teachers. As of 1974, 68% of public school teachers in Hawaii were of Japanese descent. Stewart, Dole, and Harris (1967) hypothesized that these teachers may have been more appropriate role models for Japanese-American students than for other students.

Peer-Group Influences on Achievement

In a major study of a rural Hawaii community with a relatively high proportion of Hawaiian and part-Hawaiian residents, Gallimore, Boggs, and Jordan (1974) reported on peer-group influences on school achievement. Based on children's descriptions of their peers, researchers classified children as "tough" or "nice." "Nice" boys were higher achievers than "tough" boys. If "tough" boys had higher status among their peers, it may be hypothesized that peer-group values would negatively affect school achievement.

Cultural Influences on Achievement

Comparisons within sexes. In a major study on the island of Kauai, Werner and Smith (1976) administered the California Psychological Inventory (CPI) to a sample of adolescents. In contrast to girls of Filipino or Hawaiian descent, Japanese-American girls' CPI responses corresponded to the common pattern of responses found among the norm group. Hawaii girls of Japanese descent were slightly higher than the norm

group on the achievement via independence scale but were lower than Filipino and Hawaiian girls on the achievement via conformance scale.

Comparisons between sexes. Little evidence exists about sex differences between Caucasian, Filipino, or Hawaiian boys and girls in Hawaii. Werner & Smith (1976) found that females of Filipino, Hawaiian, and Japanese descent showed higher scores than males on two CPI achievement scales and on an "intellectual efficiency" scale.

Considerable evidence is available about the differences between Japanese-American males and females in Hawaii. The evidence indicates that Japanese-American boys (a) become more deferential after immigrating, (b) are less likely than Japanese-American girls to be leaders, (c) are slow to acculturate, and (d) are more introverted and externally motivated than Japanese-American girls.

Arkoff, Meredith, and Iwahara (1962) compared males and females in Japan and Japanese-American males and females on a dominance-deference scale. While Japanese-national males and females showed dissimilar results, with males more dominant than females, Japanese-American males and females showed similar results. Statistically significant differences were found between Japanese-national and Japanese-American males but no significant differences were found between Japanese-national and Japanese-American females. These results indicated that Japanese-American males became more deferential after

immigrating to Hawaii. Meredith (1965) concluded that Japanese-American females in Hawaii may have acculturated to American culture more quickly than Japanese-American males and that Japanese-American males may have experienced a lowering of their leadership potential. Bartos and Kalish (1961) found that women of Japanese or Chinese descent at the University of Hawaii were more likely than men of the two ethnic groups to become leaders while no noteworthy differences were found between the leadership potentials of Caucasian men and women. Because of peer group norms, Japanese-American males may have resisted giving up the local Hawaii dialect in favor of standard English (Meredith, 1965). Meredith said, "the problem appears to be predominantly a male one, indicating greater flexibility of females to acquire biligual expression, or simply more concern by females to 'speak properly'" (p. 44). Kitano (1962) reported that Japanese girls in Hawaii were socially more active than Japanese boys. Meredith and Meredith (1966) said, "the traditional stereotype of a retiring-and-compliant Japanese female . . . is difficult to find" among third-generation females in Hawaii (p. 180). Werner and Smith (1976) reported results on a locus-of-control scale showing that Japanese girls were more internally motivated than Japanese boys. Meredith and Meredith (1966) compared third-generation Japanese college students on a personality inventory (the 16 PF). Male Japanese-Americans scored higher on the introversion scale than female Japanese-Americans. In a

factor analysis of personality scale data, achievement test data, and teacher ratings, Dixon, Fukuda, and Berens (1970) showed that Japanese-American girls' factor loadings of a self-confidence rating and a need for aggression scale (.20 and .19, respectively) were higher than the loadings of Japanese-American boys (.02 and .03, respectively).

## Research and Measurement Issues

Results on sex differences found in studies of mathematics achievement may generalize only to a population of Caucasian college students. Most studies of mathematics achievement have reported data on samples of middle-class Caucasians (Stein & Bailey, 1973). Many studies (see, for example, Maccoby and Jacklin's 1974 literature review) have examined samples of students at high ability levels, such as college students. It is unclear if sex differences in mathematics achievement are generalizable to students other than high ability students (Benbow & Stanley, 1983; Hyde, 1981). A meta-analysis (Hyde, 1981) of studies examined by Maccoby and Jacklin (1974) showed that studies of sex differences using selective samples (typically college students) produced larger effects than studies with less selective samples. Because boys typically quit school before girls, more high ability boys than girls may be included in studies of high school achievement. Although research shows mixed findings, some studies showing sex differences may overlook boys' and girls' differential academic

preparation in mathematics (Fennema and Sherman, 1978; Flanagan, 1982).

Many studies of sex differences show statistically significant differences that may simply be due to large Ns (Hyde, 1981; Sherman, 1978). Hyde (1981) and Sherman (1978) say that sex differences may be statistically significant or theoretically significant but not be of practical significance. However, as clarified by Rosenthal and Rubin (1982), small statistical differences may have considerable practical consequences: "Even so small an r as .20, accounting for only 4% of the variance, is associated with an increase in success rate from 40% to 60%, such as a reduction in death rate from 60% to 40% " (p. 167).

## Summary of the Literature and Purposes of this Paper

Most reviews of the literature conclude that boys surpass girls in mathematics achievement at some point in their schooling. Some studies, however, show no meaningful differences between boys and girls at any grade level. Some international studies indicate that sex differences in mathematics achievement do not always favor boys and many mainland-U.S. studies of sex differences may generalize only to higher-ability Caucasians. Researchers have concluded that sex differences are influenced by the mathematical skills assessed, sex roles, and peer group values. Some evidence exists that

ethnicity may influence sex differences in mathematics achievement.

In Hawaii, studies indicate that sex differences in mathematics achievement may favor girls. Some studies show that women in Hawaii have important roles in the workplace and in education and that Japanese-American girls may have acculturated faster than Japanese-American boys. It seems possible that sex-difference patterns among Hawaii's public school children may differ from patterns reported elsewhere.

In this paper, data are analyzed to: (a) see if findings about sex differences in mathematics achievement in Hawaii correspond to the mainland-U.S. findings, (b) provide additional information about the differential performance of boys and girls on tests of various mathematics skills and knowledge, (c) provide further evidence about sex differences in mathematics among high ability students, (d) discuss the influence of socio-cultural factors on sex differences in mathematics, and (e) discuss the practical consequences of differences in mathematics achievement between boys and girls in Hawaii.

## METHOD

The Hawaii State Department of Education (DOE) provided achievement-test raw data from its annual statewide administration of the Stanford Achievement Test (SAT) series (1973). In Table 1, the SAT-series test given at each of the

four grades, the subtests examined in this report, and the instructional objectives corresponding to each subtest are shown.

Data collected for two school years (1982-83 and 1983-84) on three mathematics subtests for Grades 4, 6, and 8 and on one mathematics subtest for Grade 10 were analyzed. Only data on Hawaii's four major ethnic groups (Caucasians, Filipinos, Hawaiians, and Japanese) were examined. The number of students in each ethnic group, categorized by year and grade, is shown in Tables 2-5.

Data analyses were as follows:

(1) Ns, means, and standard deviations were computed and categorized by gender, ethnic group, grade, and year.

(2) For Grades 4, 6, and 8, multivariate analyses of variances were conducted (for each grade, one analysis of variance was conducted for each of the two years, with the three subtest scores serving as dependent variables). For Grade 10, with one subtest as a dependent variable, univariate analyses of variance were conducted (one for 1982-83 and one for 1983-84). For all four grades, the independent variable of primary interest was gender. To identify possible sex X ethnicity interactions, ethnicity and the sex X ethnicity interaction also served as independent variables. For those subtests where significant sex X ethnicity interactions were found in the analyses of variance, post-hoc comparisons between sexes (Tukey's studentized range test) were made.

(3) To identify the magnitude of the differences in girls' and boys' mean achievement scores, the *d* statistic (categorized by ethnic group, grade, and year) was computed for each subtest. Hyde (1981) strongly recommends reporting *d* or a comparable statistic to permit comparisons between studies. To find *d*, the boys' mean score was subtracted from the girls' mean score and the result was divided by the standard deviation of both sexes. Average *d*s were computed across subtests, grades, and ethnic groups.

(4) To show the practical consequences of differences between Hawaii boys' and girls' achievement, Rosenthal and Rubin's (1982a, 1982b)) binomial effect-size display (BESD) method was used. Rosenthal and Rubin's BESD method gives the percents of boys and the percents of girls scoring above the means of the tests. For the higher-achieving group, the percent above a mean is computed as $(.50 + r/2) \times 100$ and for the lower-achieving group, the percent above a mean is computed as $(.50 - r/2) \times 100$, where *r* is the correlation between independent and dependent variables.

(5) To see if sex differences favor boys among high ability groups, SAT raw scores for all four grades in each of the 1982-83 and 1983-84 school years were transformed into decile scores and categorized by ethnic group.

## RESULTS

In Tables 2-4, *N*s, means, and standard deviations are

shown for Grades 4, 6, and 8, with one table for each subtest. The results on the mathematics applications subtest are shown in Table 2, the results on the mathematics computation subtest are shown in Table 3, and the results on the mathematics concepts subtest are shown in Table 4. Grade 10 results are presented in Table 5. As seen in Tables 2-5, girls at all grade levels outperformed boys in 76 of the 80 comparisons between sexes (fourth-grade Caucasians boys outperformed Caucasian girls in mathematics concepts, both in 1982-83 and in 1983-84, and sixth-grade Caucasians boys outperformed Caucasian girls in mathematics applications in both 1982-83 and 1983-84).

As seen in Table 6, multivariate analyses of variance (with the three subtests as dependent variables) for Grades 4, 6, and 8 show statistically significant differences between girls and boys in both 1982-83 and 1983-84 and statistically significant gender X ethnicity interaction effects for Grades 4, 6, and 8 in 1982-83 and Grade 4 in 1983-84 (gender X ethnicity interactions were not significant for Grades 6 and 8, 1983). In univariate analyses of variance for Grade 10, the girl-boy comparisons and the gender X ethnicity interactions were statistically significant in both years.

Post-hoc comparisons (see Table 7) show fewer statistically significant differences between Caucasian girls and boys than between girls and boys of the other three major ethnic groups in Hawaii. It was thought that the relatively smaller differences between Caucasian boys and girls might be

due to the high number of mainland Caucasians performing military service and living on the island of Oahu. However, correlations between the Caucasian girl-boy difference in mean mathematics achievement scores for each Oahu school and the proportion of military-family students in each Oahu school were small (< .29) and statistically insignificant.

For Grades 4, 6, and 8, more significant post-hoc comparisons between boys and girls in the four ethnic groups were found in the mathematics applications and mathematics computation subtests than in the mathematics concepts subtest. More of the significant post-hoc comparisons within ethnic groups were found in comparisons of Grade 4 mathematics computation results and Grade 10 mathematics results than in comparisons of other grade X subtest results.

For Grades 4, 6, and 8, the differences between girls and boys (expressed as $\underline{d}$ statistics) are shown in Table 8, categorized by subtest, ethnic group, and year. For Grade 10, the $\underline{d}$s are shown in Table 5, categorized by ethnic group and year. Across all four grades, the $\underline{d}$s range from -.12 (favoring boys) to .48 (favoring girls). Comparing the subtest results (both years combined) across Grades 4, 6, and 8, $\underline{d}$ for mathematics applications = .09, for mathematics concepts = .13, and for mathematics computation = .27. The higher the grade, the greater the differences between boys and girls: the average difference (both years combined) is .12 for Grade 4, .15 for Grade 6, .22 for Grade 8, and .26 for Grade 10.

In Table 9, the percents of Hawaii girls and boys performing above the means of the SAT mathematics subtests, both years combined, is shown in a binomial effect-size display (BESD). With the BESD, the percent of the higher-achieving group above a mean is computed as (.50 + $\underline{r}$/2) X 100 and the percent of the lower-achieving group above a mean is computed as (.50 - $\underline{r}$/2) X 100. The smallest difference between percents is .02 (mathematics concepts, Grade 4 and mathematics applications, Grade 6) and the largest difference is .18 (mathematics computation, Grade 8). No trend across grades is seen in mathematics applications; a trend across grades slightly favoring girls is seen in mathematics concepts. The strongest trend across grades favors girls in the mathematics computation results. Using the results shown on Table 9, it can be shown that the average difference between boys and girls (all subtests combined) doubles from Grade 4 to Grade 10.

In Tables 10 and 11, the differences in percentages of boys and girls in deciles on the mathematics subtests are shown, categorized by ethnic group. In Table 10, results are shown for the 1982-83 school year, and in Table 11, results are shown for the 1983-84 school year. Results for 1982-83 show relatively higher percentages of boys than girls (all ethnic groups combined) in the 10th deciles only for Grade 4 in mathematics applications and mathematics concepts and for Grade 6 in mathematics applications. Results for 1983-84 show higher percentages of boys than girls (all ethnic groups combined) in

the 10th decile only for Grade 6 in mathematics applications.

## DISCUSSION

### What Are the Hawaii Findings About Sex Differences in Mathematics Achievement?

Contrasted with most studies, the study reported here shows girls with higher mathematics achievement levels than boys. That the Hawaii data show differences in mathematics achievement favoring girls is not surprising: previous Hawaii studies give clues about Hawaii girls' superiority over boys in mathematics. The differences between girls and boys are found as early as Grade 4, the earliest grade examined in this study, and the differences increase as the grade levels increase. The range of d statistics reported here (-.12, favoring boys, to .48, favoring girls) is similar to the ranges reported in some other studies (for example, Hilton & Berglund, 1974, Husen, 1967, and Lewis & Hoover, 1983), but the direction of the signs of the ds is opposite that found in most other studies. The differences found favoring Hawaii girls are smaller, however, than the differences found favoring boys in Hyde's (1981) meta-analysis and much smaller than the differences favoring boys reported in the Benbow and Stanley studies (1980, 1982, 1983).

Until now, a reasonable conclusion in the literature about sex differences has been that boys overtake girls in mathematics achievement at some point in their schooling.

Perhaps a more accurate conclusion is that sex differences vary by ethnicity and are on a continuum ranging from moderate differences favoring girls to large differences favoring boys. The Hawaii data support the Schratz (1978) findings that show non-Caucasian girls outperforming non-Caucasian boys in mathematics achievement. Differences favoring girls (not statistically significant) also were reported among Japanese and Taiwanese nationals by Stigler et al (1982). Peck (1971) found no significant differences between boys and girls within seven countries.

Because of the large Ns of the groups studied here, the statistically significant findings are not remarkable and, indeed, may even not be meaningful. With large Ns, analyses of variance perhaps are most meaningful when significant differences are not found -- that is, when differences between groups are too small to be significant, no matter how large the N. Statistically significant differences were not found in two tests of gender X ethnicity interactions reported here. Consequently, in a statistical sense, the overall sex differences in the mathematics achievement of Hawaii boys and girls are not uniform among ethnic groups across years. However, methods other than significance tests have helped clarify the results reported here. When Hawaii boys' and girls' achievement is examined (a) for differences that vary according to the skill assessed, (b) for differences among high ability students, (c) for differences due to socio-cultural

factors, and (d) for the practical consequences of boy-girl differences, the results are meaningful and useful.

### How Does Boys' and Girls' Achievement Vary on Subtests?

The findings reported here provide further evidence that boys achieve their highest mathematics scores on tests of mathematics reasoning, such as the mathematics applications subtests of the Stanford Achievement Test series (see Table 1). The results shown here support the large body of literature showing girls' highest achievement in computation problems. However, in contrast with other studies, the Hawaii data show boys' achievement is less than girls' on all subtests in all four grades in both years except for Caucasian boys in Grade 6, mathematics applications (both years) and in Grade 4, mathematics concepts (both years).

### Are Sex Differences Favoring Boys Found Among High Ability Students in Hawaii?

The findings given in Tables 10 and 11 show that Hawaii public school girls outperform Hawaii public school boys even in the subtests' 10th deciles. For all ethnic groups combined, 20 comparisons were made in the 10th deciles. For Grades 4, 6, and 8, 18 comparisons were made (2 years X 3 grades X 3 subtests) and for Grade 10, 2 comparisons were made (2 years X 1 subtest). Higher percentages of boys than girls are found in only four of the 20 comparisons in the 10th deciles.

Children scoring in the 10th deciles of SAT subtests in Hawaii, however, might not be achieving at the high levels of some groups studied elsewhere (for example, Benbow & Stanley, 1980, 1982, 1983). Compared with 1973 norms, SAT mean scores of the combined group of all four ethnicities studied here range from .08 of a standard deviation below to .43 of a standard deviation above the norm group means. Compared with other states, a high proportion of elementary- and secondary-level students in Hawaii attend private schools; assuming that high ability students attend private schools, the data shown here do not represent the highest-achieving students in the state.

Japanese-American children, however, are high achievers, even in Hawaii public schools. Compared with the 1973 SAT norm group, the mean scores shown here of Japanese-American public school students in Hawaii are from .40 to 1.06 standard deviations above the norm group. In a separate analysis of the 1983-84 Hawaii SAT data studied in this report, results showed 20% of 1983-84 8th-grade Japanese-American students in the ninth stanine (that is, in the top 4% of the 1973 norm group) on an SAT total-mathematics subtest (Brandon, 1984). However, among Japanese-American children, fewer boys than girls score in the 10th deciles of the SAT mathematics subtests. Of the 80 girl-boy 10th-decile comparisons reported here (for Grades 4, 6, and 8, 2 years X 3 grades X 4 ethnic groups X 3 subtests = 72 comparisons; for Grade 10, 2 years X 4 ethnic groups = 8

comparisons), only three comparisons favor Japanese boys. Of the 80 comparisons, only 8 show more than 5-point differences in the percentages of boys and girls in the 10th deciles. All 8 of these comparisons show Japanese girls with higher percentages in the 10th deciles than boys.

## Do Socio-Cultural Factors Influence Sex Differences in Mathematics?

Some mainland-U.S. and international studies (Husen, 1967; Schratz, 1978) have concluded that culture or ethnicity may influence sex differences and considerable evidence shows possible reasons why Hawaii girls are higher achievers than Hawaii boys, particularly among Japanese-American children. As shown in our review of the literature, Japanese-American girls in Hawaii are more achievement-oriented than girls of the other ethnic groups studied here. Because of the high proportion of female Japanese-American public school teachers in Hawaii, girls may have powerful female sex role models showing that academic achievement is possible and desireable. Japanese-American girls are more inclined to achieve than Japanese-American boys. This may be due to (a) declines in Japanese-American boys' need for achievement and dominance, and in their potential for leadership or (b) increases in the need for achievement and in the leadership potential of Japanese-American girls, or both. The literature indicates that Japanese-American boys do not acculturate as quickly as

Japanese-American girls (Meredith, 1965) and peer values may not favor high achievement. Brenner (1984a, 1984b) found that boys outperformed girls in a culturally compatible curriculum for children of Hawaiian descent; these findings tentatively indicate that the interaction between curriculum and ethnicity may affect boys' achievement motivation.

Hypotheses about socio-cultural influences on sex differences in mathematics achievement are supported by the differential achievement of Hawaii's Caucasian boys. Although Caucasian public school girls achieve higher mean scores than Caucasian public school boys in Hawaii, the differences between Caucasian boys and girls are smaller than the differences between boys and girls of the other ethnic groups, as clearly seen in the results of the post-hoc tests (Table 7). Of the 48 post-hoc comparisons showing the superiority of girls over boys, 33 were statistically significant; of these 33, only four showed significant differences favoring Caucasian girls over Caucasian boys. In the data presented here, only four differences favored boys' mean scores over girls' mean scores; all four were among Caucasians. Of the 21 comparisons favoring boys over girls in the 10th deciles (see Tables 10 and 11), 12 show higher percentages of Caucasian boys over Caucasian girls. The cultural characteristics accounting for the superiority of Caucasian boys over Caucasian girls in mainland-U.S. studies might be influencing Caucasians in Hawaii.

## What Are Some Possible Practical Consequences of Sex Differences in Hawaii?

The differences reported here between Hawaii girls and boys may have practical consequences (Rosenthal & Rubin, 1982a). In Grade 10, the binominal effect-size display (given in Table 9) shows a 14% difference in the percentages of Hawaii girls and boys with scores above the mathematics subtest means. This difference may have consequences on the advanced mathematics training and the career choices of Hawaii boys. Assuming that the differences between Hawaii boys and girls continue into adulthood, the consequences of these differences might be particularly clear in young men and women's performances on personnel selection tests such as those widely used in civil service hiring. For some civil service jobs, written tests commonly consist solely of mathematics items. If the pass point of such a civil service test were set at the mean, and if sex differences between job applicants were the same as the differences between 10th-graders reported here, it is likely that 57% of the girls would pass the test but only 43% of the boys would pass the test.

## Future Research

Several possible influences on sex differences in Hawaii remain for further research. It is unknown if Hawaii public school girls have better attendance records than boys, have lower dropout rates than boys, do more mathematics homework

than boys, spend more time on mathematics tasks in classrooms, are encouraged more by their parents than boys, or are rewarded more than boys for mathematics achievement. The responses of Hawaii boys and girls on individual mathematics items have yet to be examined. Factor- or cluster-analyses of mathematics items might help identify patterns of Hawaii boys' and girls' responses on mathematics tests and help clarify the relative strengths and weaknesses of boys and girls.

Questions about the effects of acculturation and ethnicity on mathematics achievement remain unclear. How does acculturation affect sex-role expectations? How is acculturation different for boys than it is for girls? Does the achievement motivation of boys living in a culture alien to their own culture vary by ethnic group? What causes Caucasian boys to perform below girls in mathematics in Hawaii when Caucasian boys on the mainland United States outperform girls? Wherever data on ethnicity are available in mainland-U.S. research, the effect of ethnicity on sex differences in mathematics achievement should be considered.

Table 1

Instructional Objectives of Tests in the Stanford Achievement Test Series (6th Edition) Administered to Hawaii Fourth, Sixth, Eighth, and Tenth Grade Students, by Subtest

| Grade | S.A.T. series test | Instructional objectives by subtest | | | |
|---|---|---|---|---|---|
| | | Mathematics Applications | Mathematics Computation | Mathematics Concepts | Mathematics |
| 4 | Primary Level III | Solution of one-step problems<br>Analysis and development of solution designs<br>Measurement and graphs | Knowledge of primary facts<br>Addition and subtraction algorithms<br>Multiplication and division algorithms | Numbers<br>Notation<br>Operations<br>Geometry and measurement | |
| 6 | Intermediate Level II | Selection of an appropriate operation<br>Analysis and development of solution designs<br>Rate and scale problems<br>Measurement<br>Graph reading and interpretation | Knowledge of primary facts and solution of simple mathematical sentences<br>Addition and subtraction algorithms<br>Multiplication and division algorithms<br>Common fractions | Numbers<br>Notation<br>Operations<br>Geometry and measurement | |
| 8 | Advanced | Analysis and development of solution designs, selection of solution sentences, and adequacy of data<br>Rate, scale, and percent<br>Measurement<br>Graph reading and interpretation<br>Statistics, averages, and probability | Knowledge of primary facts and solution of simple mathematical sentences<br>Addition and subtraction algorithms<br>Multiplication and division algorithms<br>Common fractions<br>Other operational models | Numbers<br>Notation<br>Operations<br>Geometry and measurement | |
| 10 | Test of Academic Skills | | | | Numbers, symbols, and sets<br>Number properties and operations<br>Mathematical sentences<br>Geometry and measurement<br>Ratio and percent<br>Graphs, probability, and statistics<br>Mathematical reasoning |

Table 2

Grades 4, 6, and 8: Hawaii Girls' and Boys' Results on the Stanford Achievement Test, Mathematics Applications Subtest, by Ethnic Group and Year

| Ethnic group | Year | Sex | Grade 4 | | | Grade 6 | | | Grade 8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Number | Mean | S.D. | Number | Mean | S.D. | Number | Mean | S.D. |
| Caucasians | 1982 | Girls | 1,110 | 18.61 | 6.40 | 1,179 | 25.31 | 8.00 | 864 | 24.54 | 8.50 |
| | | Boys | 1,178 | 18.51 | 7.08 | 1,228 | 25.54 | 8.52 | 905 | 24.35 | 9.01 |
| | | Total | 2,288 | 18.56 | 6.76 | 2,407 | 25.43 | 8.27 | 1,769 | 24.45 | 8.77 |
| | 1983 | Girls | 1,207 | 19.14 | 6.38 | 1,176 | 24.80 | 8.66 | 1,107 | 24.72 | 8.39 |
| | | Boys | 1,237 | 18.46 | 7.07 | 1,259 | 25.01 | 8.76 | 1,137 | 24.22 | 8.90 |
| | | Total | 2,444 | 18.80 | 6.75 | 2,435 | 24.91 | 8.71 | 2,244 | 24.47 | 8.65 |
| Filipinos | 1982 | Girls | 962 | 15.37 | 6.29 | 1,105 | 20.95 | 8.64 | 893 | 20.18 | 8.49 |
| | | Boys | 980 | 14.16 | 6.65 | 1,027 | 19.96 | 8.48 | 962 | 18.82 | 8.44 |
| | | Total | 1,942 | 14.76 | 6.50 | 2,132 | 20.47 | 8.58 | 1,855 | 19.48 | 8.49 |
| | 1983 | Girls | 1,011 | 15.94 | 6.22 | 1,150 | 20.64 | 8.32 | 1,122 | 20.01 | 8.64 |
| | | Boys | 1,086 | 14.53 | 6.67 | 1,179 | 20.21 | 8.73 | 1,229 | 18.41 | 8.48 |
| | | Total | 2,097 | 15.21 | 6.50 | 2,329 | 20.43 | 8.53 | 2,351 | 19.18 | 8.59 |
| Hawaiians | 1982 | Girls | 999 | 15.13 | 6.35 | 1,022 | 19.74 | 8.62 | 944 | 18.77 | 7.96 |
| | | Boys | 1,000 | 13.99 | 6.79 | 1,120 | 19.14 | 8.39 | 980 | 17.08 | 8.08 |
| | | Total | 1,999 | 14.56 | 6.60 | 2,142 | 19.42 | 8.50 | 1,924 | 17.91 | 8.06 |
| | 1983 | Girls | 1,080 | 15.08 | 6.65 | 1,120 | 19.57 | 8.42 | 1,160 | 18.90 | 8.04 |
| | | Boys | 1,213 | 14.04 | 6.95 | 1,135 | 19.22 | 8.37 | 1,154 | 16.94 | 7.81 |
| | | Total | 2,293 | 14.53 | 6.82 | 2,255 | 19.39 | 8.39 | 2,314 | 17.92 | 7.99 |
| Japanese | 1982 | Girls | 841 | 20.39 | 5.94 | 1,015 | 27.69 | 8.20 | 957 | 28.21 | 8.11 |
| | | Boys | 856 | 19.87 | 6.35 | 1,023 | 27.70 | 8.18 | 1,030 | 27.06 | 8.69 |
| | | Total | 1,697 | 20.13 | 6.15 | 2,038 | 27.70 | 8.19 | 1,987 | 27.61 | 8.43 |
| | 1983 | Girls | 857 | 20.80 | 5.74 | 953 | 27.85 | 8.02 | 1,087 | 28.31 | 7.94 |
| | | Boys | 891 | 20.39 | 6.02 | 1,000 | 26.94 | 8.60 | 1,122 | 27.03 | 8.66 |
| | | Total | 1,748 | 20.59 | 5.88 | 1,953 | 27.38 | 8.33 | 2,209 | 27.66 | 8.34 |
| All four groups | 1982 | Girls | 3,912 | 17.31 | 6.62 | 4,321 | 23.44 | 8.94 | 3,658 | 22.95 | 9.07 |
| | | Boys | 4,014 | 16.61 | 7.21 | 4,398 | 23.11 | 9.13 | 3,877 | 21.86 | 9.48 |
| | | Total | 7,926 | 16.96 | 6.94 | 8,719 | 23.27 | 9.04 | 7,535 | 22.39 | 9.30 |
| | 1983 | Girls | 4,155 | 17.65 | 6.68 | 4,399 | 23.04 | 8.97 | 4,476 | 22.90 | 9.07 |
| | | Boys | 4,427 | 16.67 | 7.22 | 4,573 | 22.76 | 9.18 | 4,642 | 21.55 | 9.41 |
| | | Total | 8,582 | 17.15 | 6.98 | 8,972 | 22.90 | 9.08 | 9,118 | 22.21 | 9.27 |

Table 3

Grades 4, 6, and 8: Hawaii Girls' and Boys' Results on the Stanford Achievement Test, Mathematics Computation Subtest, by Ethnic Group and Year

| Ethnic group | Year | Sex | Grade 4 | | | Grade 6 | | | Grade 8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Number | Mean | S.D. | Number | Mean | S.D. | Number | Mean | S.D. |
| Caucasians | 1982 | Girls | 1,110 | 22.08 | 6.72 | 1,179 | 27.45 | 8.14 | 864 | 28.13 | 7.94 |
| | | Boys | 1,178 | 21.37 | 6.92 | 1,228 | 26.13 | 8.61 | 905 | 26.23 | 8.96 |
| | | Total | 2,288 | 21.72 | 6.83 | 2,407 | 26.77 | 8.41 | 1,769 | 27.16 | 8.53 |
| | 1983 | Girls | 1,207 | 22.03 | 6.82 | 1,176 | 27.19 | 8.15 | 1,107 | 28.17 | 8.30 |
| | | Boys | 1,237 | 20.97 | 6.94 | 1,259 | 25.48 | 8.53 | 1,137 | 25.75 | 8.60 |
| | | Total | 2,444 | 21.50 | 6.90 | 2,435 | 26.31 | 8.39 | 2,244 | 26.94 | 8.54 |
| Filipinos | 1982 | Girls | 962 | 22.44 | 6.74 | 1,105 | 27.61 | 7.57 | 893 | 27.18 | 7.99 |
| | | Boys | 980 | 20.76 | 6.65 | 1,027 | 24.56 | 7.97 | 962 | 24.03 | 8.03 |
| | | Total | 1,942 | 21.59 | 6.74 | 2,132 | 26.14 | 7.91 | 1,855 | 25.55 | 8.16 |
| | 1983 | Girls | 1,011 | 22.74 | 6.61 | 1,150 | 26.86 | 7.76 | 1,122 | 27.22 | 8.01 |
| | | Boys | 1,086 | 20.52 | 6.60 | 1,179 | 24.57 | 8.11 | 1,229 | 24.12 | 7.93 |
| | | Total | 2,097 | 21.59 | 6.69 | 2,329 | 25.70 | 8.02 | 2,351 | 25.60 | 8.12 |
| Hawaiians | 1982 | Girls | 999 | 20.82 | 6.56 | 1,022 | 24.87 | 7.96 | 944 | 24.58 | 7.64 |
| | | Boys | 1,000 | 18.84 | 6.54 | 1,120 | 22.50 | 7.93 | 980 | 20.95 | 7.59 |
| | | Total | 1,999 | 19.83 | 6.62 | 2,142 | 23.63 | 8.03 | 1,924 | 22.73 | 7.83 |
| | 1983 | Girls | 1,080 | 20.78 | 6.80 | 1,120 | 24.50 | 7.76 | 1,160 | 24.68 | 7.65 |
| | | Boys | 1,213 | 18.80 | 6.59 | 1,135 | 21.96 | 7.64 | 1,154 | 20.94 | 7.41 |
| | | Total | 2,293 | 19.73 | 6.76 | 2,255 | 23.22 | 7.80 | 2,314 | 22.81 | 7.76 |
| Japanese | 1982 | Girls | 841 | 26.54 | 6.64 | 1,015 | 32.60 | 7.62 | 957 | 33.37 | 7.69 |
| | | Boys | 856 | 24.63 | 7.12 | 1,023 | 30.70 | 8.26 | 1,030 | 30.78 | 8.50 |
| | | Total | 1,697 | 25.57 | 6.95 | 2,038 | 31.65 | 8.00 | 1,987 | 32.02 | 8.22 |
| | 1983 | Girls | 857 | 26.41 | 6.60 | 953 | 32.35 | 7.10 | 1,087 | 33.57 | 7.57 |
| | | Boys | 891 | 25.08 | 6.85 | 1,000 | 29.64 | 8.36 | 1,122 | 30.83 | 8.63 |
| | | Total | 1,748 | 25.73 | 6.76 | 1,953 | 30.96 | 7.89 | 2,209 | 32.18 | 8.23 |
| All four groups | 1982 | Girls | 3,912 | 22.81 | 6.97 | 4,321 | 28.09 | 8.29 | 3,658 | 28.35 | 8.46 |
| | | Boys | 4,014 | 21.29 | 7.09 | 4,398 | 25.90 | 8.72 | 3,877 | 25.56 | 9.04 |
| | | Total | 7,926 | 22.04 | 7.07 | 8,719 | 26.99 | 8.58 | 7,535 | 26.91 | 8.87 |
| | 1983 | Girls | 4,155 | 22.78 | 7.00 | 4,399 | 27.54 | 8.20 | 4,476 | 28.34 | 8.52 |
| | | Boys | 4,427 | 21.09 | 7.08 | 4,573 | 25.28 | 8.59 | 4,642 | 25.35 | 8.88 |
| | | Total | 8,582 | 21.91 | 7.10 | 8,972 | 26.39 | 8.47 | 9,118 | 26.82 | 8.83 |

Table 4
Grades 4, 6, and 8: Hawaii Girls' and Boys' Results on the Stanford Achievement Test, Mathematics Concepts Subtest, by Ethnic Group and Year

| Ethnic group | Year | Sex | Grade 4 | | | Grade 6 | | | Grade 8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Number | Mean | S.D. | Number | Mean | S.D. | Number | Mean | S.D. |
| Caucasians | 1982 | Girls | 1,110 | 18.34 | 5.83 | 1,179 | 21.86 | 6.19 | 864 | 19.84 | 6.53 |
| | | Boys | 1,178 | 19.04 | 6.01 | 1,228 | 21.55 | 6.41 | 905 | 19.46 | 6.75 |
| | | Total | 2,288 | 18.70 | 5.94 | 2,407 | 21.71 | 6.30 | 1,769 | 19.65 | 6.65 |
| | 1983 | Girls | 1,207 | 18.36 | 5.76 | 1,176 | 21.76 | 6.11 | 1,107 | 20.16 | 6.45 |
| | | Boys | 1,237 | 18.68 | 6.05 | 1,259 | 21.11 | 6.35 | 1,137 | 19.08 | 6.62 |
| | | Total | 2,444 | 18.52 | 5.91 | 2,435 | 21.42 | 6.25 | 2,244 | 19.61 | 6.56 |
| Filipinos | 1982 | Girls | 962 | 16.56 | 5.89 | 1,105 | 20.65 | 6.08 | 893 | 18.04 | 6.76 |
| | | Boys | 980 | 15.97 | 5.71 | 1,027 | 19.22 | 6.04 | 962 | 16.41 | 6.54 |
| | | Total | 1,942 | 16.26 | 5.81 | 2,132 | 19.96 | 6.10 | 1,855 | 17.19 | 6.69 |
| | 1983 | Girls | 1,011 | 16.80 | 5.74 | 1,150 | 20.21 | 5.89 | 1,122 | 17.77 | 6.68 |
| | | Boys | 1,086 | 16.04 | 5.70 | 1,179 | 19.19 | 6.03 | 1,229 | 16.28 | 6.28 |
| | | Total | 2,097 | 16.41 | 5.73 | 2,329 | 19.70 | 5.98 | 2,351 | 16.99 | 6.51 |
| Hawaiians | 1982 | Girls | 999 | 15.80 | 5.54 | 1,022 | 19.31 | 5.87 | 944 | 16.57 | 6.13 |
| | | Boys | 1,000 | 15.16 | 5.53 | 1,120 | 17.83 | 6.33 | 980 | 14.76 | 5.93 |
| | | Total | 1,999 | 15.48 | 5.54 | 2,142 | 18.53 | 6.16 | 1,924 | 15.65 | 6.10 |
| | 1983 | Girls | 1,080 | 15.49 | 5.87 | 1,120 | 19.07 | 5.98 | 1,160 | 16.48 | 6.03 |
| | | Boys | 1,213 | 15.25 | 5.66 | 1,135 | 17.81 | 6.20 | 1,154 | 14.47 | 5.85 |
| | | Total | 2,293 | 15.37 | 5.76 | 2,255 | 18.43 | 6.13 | 2,314 | 15.48 | 6.02 |
| Japanese | 1982 | Girls | 841 | 20.78 | 5.60 | 1,015 | 24.94 | 5.84 | 957 | 23.83 | 6.34 |
| | | Boys | 856 | 20.70 | 5.92 | 1,023 | 24.05 | 6.11 | 1,030 | 22.17 | 6.71 |
| | | Total | 1,697 | 20.74 | 5.76 | 2,038 | 24.49 | 5.99 | 1,987 | 22.97 | 6.59 |
| | 1983 | Girls | 857 | 20.97 | 5.78 | 953 | 24.93 | 5.46 | 1,087 | 23.77 | 6.24 |
| | | Boys | 891 | 20.57 | 6.06 | 1,000 | 23.65 | 6.32 | 1,122 | 22.16 | 6.74 |
| | | Total | 1,748 | 20.77 | 5.93 | 1,953 | 24.27 | 5.95 | 2,209 | 22.95 | 6.55 |
| All four groups | 1982 | Girls | 3,912 | 17.78 | 6.01 | 4,321 | 21.67 | 6.34 | 3,658 | 19.60 | 7.00 |
| | | Boys | 4,014 | 17.68 | 6.20 | 4,398 | 20.64 | 6.65 | 3,877 | 18.24 | 7.10 |
| | | Total | 7,926 | 17.73 | 6.11 | 8,719 | 21.15 | 6.52 | 7,535 | 18.90 | 7.09 |
| | 1983 | Girls | 4,155 | 17.77 | 6.10 | 4,399 | 21.36 | 6.25 | 4,476 | 19.48 | 6.93 |
| | | Boys | 4,427 | 17.47 | 6.21 | 4,573 | 20.35 | 6.58 | 4,642 | 17.94 | 7.00 |
| | | Total | 8,582 | 17.62 | 6.16 | 8,972 | 20.84 | 6.44 | 9,118 | 18.70 | 7.01 |

Table 5

Grade 10: Hawaii Girls' and Boys' Results on the Stanford Test of Academic Skills, Mathematics Subtest, by Ethnic Group and Year

| Ethnic group | Year | Sex | Number | Mean | S.D. | Difference[a] |
|---|---|---|---|---|---|---|
| Caucasians | 1982 | Girls | 710 | 36.52 | 8.71 | |
| | | Boys | 710 | 35.47 | 9.71 | 0.11 |
| | | Total | 1,420 | 36.00 | 9.24 | |
| | 1983 | Girls | 909 | 36.93 | 8.27 | |
| | | Boys | 893 | 35.16 | 10.44 | 0.19 |
| | | Total | 1,802 | 36.05 | 9.45 | |
| Filipinos | 1982 | Girls | 941 | 33.54 | 9.27 | |
| | | Boys | 996 | 30.72 | 10.33 | 0.28 |
| | | Total | 1,937 | 32.09 | 9.92 | |
| | 1983 | Girls | 1,014 | 33.48 | 9.53 | |
| | | Boys | 1,196 | 30.02 | 10.01 | 0.35 |
| | | Total | 2,210 | 31.61 | 9.94 | |
| Hawaiians | 1982 | Girls | 809 | 30.91 | 9.05 | |
| | | Boys | 833 | 27.62 | 10.10 | 0.34 |
| | | Total | 1,642 | 29.24 | 9.74 | |
| | 1983 | Girls | 943 | 31.12 | 9.09 | |
| | | Boys | 922 | 27.37 | 10.01 | 0.39 |
| | | Total | 1,865 | 29.26 | 9.74 | |
| Japanese | 1982 | Girls | 1,032 | 40.77 | 7.06 | |
| | | Boys | 995 | 39.36 | 8.47 | 0.18 |
| | | Total | 2,027 | 40.08 | 7.81 | |
| | 1983 | Girls | 1,008 | 40.75 | 7.07 | |
| | | Boys | 989 | 38.50 | 9.04 | 0.28 |
| | | Total | 1,997 | 39.64 | 8.18 | |
| All four groups | 1982 | Girls | 3,492 | 35.67 | 9.30 | |
| | | Boys | 3,534 | 33.37 | 10.67 | 0.23 |
| | | Total | 7,026 | 34.52 | 10.08 | |
| | 1983 | Girls | 3,874 | 35.61 | 9.29 | |
| | | Boys | 4,000 | 32.65 | 10.77 | 0.29 |
| | | Total | 7,874 | 34.11 | 10.17 | |
| | Avg. of '82 & '83 | --- | --- | --- | --- | 0.26 |

[a] $\text{Difference} = \frac{(\text{mean}_{\text{girls}} - \text{mean}_{\text{boys}})}{\text{standard deviation}_{\text{girls and boys combined}}}$

Table 6
Analyses of Variance of Three Mathematics Subtests of the
Stanford Achievement Test Series for Four Grades in 1982 and 1983

| Source | Year | Grade 4 | | | | | Grade 6 | | | | | Grade 8 | | | | | Grade 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Univariate F ratio by subtest | | | | | Univariate F ratio by subtest | | | | | Univariate F ratio by subtest | | | | |
| | | df | Multivariate F ratio[a] | Math Applications | Math Computation | Math Concepts | df | Multivariate F ratio[a] | Math Applications | Math Computation | Math Concepts | df | Multivariate F ratio[a] | Math Applications | Math Computation | Math Concepts | df | Total Math subtest univariate F ratio |
| Gender | 1982 | 1 | 53.02* | 22.62* | 100.90* | .60 | 1 | 96.95* | 3.35 | 162.09* | 61.50* | 1 | 111.64* | 31.60* | 226.31* | 84.05* | 1 | 112.30* |
| | 1983 | 1 | 60.72* | 48.02* | 134.55* | 5.64*** | 1 | 112.44* | 2.41 | 180.59* | 61.57* | 1 | 139.92* | 59.37* | 315.31* | 134.34* | 1 | 200.94* |
| Ethnicity | 1982 | 3 | 169.52* | 346.76* | 232.22* | 319.82* | 3 | 214.98* | 472.12* | 359.72* | 365.68* | 3 | 216.07* | 546.93* | 459.83* | 477.08* | 3 | 490.80* |
| | 1983 | 3 | 187.01* | 396.76* | 269.68* | 333.49* | 3 | 192.30* | 420.47* | 342.13* | 363.72* | 3 | 281.53* | 672.61* | 540.26* | 598.35* | 3 | 483.76* |
| Gender X ethnicity | 1982 | 3 | 2.96** | 3.47*** | 4.04** | 6.40** | 3 | 2.51** | 2.49 | 4.66** | 4.60** | 3 | 2.58** | 2.67*** | 3.96** | 4.75** | 3 | 5.87** |
| | 1983 | 3 | 2.94** | 2.18 | 3.62** | 3.42*** | 3 | .93 | --- | --- | --- | 3 | 1.71 | --- | --- | --- | 3 | 5.01** |
| Error | 1982 | 7,919 | | | | | 8,712 | | | | | 7,528 | | | | | 7,019 | |
| | 1983 | 8,575 | | | | | 8,965 | | | | | 9,119 | | | | | 7,867 | |

[a]Wilk's criterion
* $p < .0001$
** $p < .01$
*** $p < .05$

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Table 7
Post-Hoc Comparisons[a] of Hawaii Girls' and Boys Mean Mathematics Scores Within Ethnic Groups, by Year

| Ethnic group | Year | Stanford Achievement Test subtest, by grade | | | | | | | | | Total Math (Grade 10 only) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Applications | | | Computation | | | Concepts | | | |
| | | 4 | 6 | 8 | 4 | 6 | 8 | 4 | 6 | 8 | |
| Caucasians | 1982 | NS | -- | NS | NS | S | S | NS | NS | NS | NS |
| | 1983 | -- | -- | -- | S | -- | -- | NS | -- | -- | S |
| Filipinos | 1982 | S | -- | S | S | S | S | NS | S | S | S |
| | 1983 | -- | -- | -- | S | -- | -- | NS | -- | -- | S |
| Hawaiians | 1982 | S | -- | S | S | S | S | NS | S | S | S |
| | 1983 | -- | -- | -- | S | -- | -- | NS | -- | -- | S |
| Japanese | 1982 | NS | -- | S | S | S | S | NS | S | S | S |
| | 1983 | -- | -- | -- | S | -- | -- | NS | -- | -- | S |

[a]Tukey's studentized range test. Significance is at the .05 level. S = significant and NS = not significant. Comparisons were made only for those subtests where significant gender X ethnicity interactions were found in analyses of variance.

Table 8

Grades 4, 6, and 8: Differences[a] Between Hawaii Girls and Boys on Three Stanford Achievement Test Mathematics Subtests, by Ethnic Group and Year

| Ethnic group | Year | Subtest and grade: Math Applications 4 | 6 | 8 | Avg. | Math Computation 4 | 6 | 8 | Avg. | Math Concepts 4 | 6 | 8 | Avg. | Average of all three subtests 4 | 6 | 8 | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Caucasians | 1982 | 0.01 | -0.03 | 0.02 | 0.00 | 0.10 | 0.16 | 0.22 | 0.16 | -0.12 | 0.05 | 0.06 | 0.00 | 0.00 | 0.06 | 0.10 | 0.05 |
| | 1983 | 0.10 | -0.02 | 0.06 | 0.04 | 0.15 | 0.20 | 0.28 | 0.21 | -0.05 | 0.10 | 0.16 | 0.07 | 0.07 | 0.09 | 0.17 | 0.11 |
| | '82 & '83 | 0.06 | -0.03 | 0.04 | 0.02 | 0.13 | 0.18 | 0.25 | 0.19 | -0.09 | 0.08 | 0.11 | 0.03 | 0.03 | 0.08 | 0.13 | 0.08 |
| Filipinos | 1982 | 0.19 | 0.12 | 0.16 | 0.17 | 0.25 | 0.39 | 0.39 | 0.34 | 0.10 | 0.23 | 0.24 | 0.19 | 0.18 | 0.25 | 0.26 | 0.24 |
| | 1983 | 0.22 | 0.05 | 0.19 | 0.15 | 0.33 | 0.29 | 0.38 | 0.33 | 0.13 | 0.17 | 0.23 | 0.18 | 0.23 | 0.17 | 0.27 | 0.22 |
| | '82 & '83 | 0.20 | 0.11 | 0.17 | 0.16 | 0.29 | 0.34 | 0.38 | 0.34 | 0.12 | 0.20 | 0.24 | 0.19 | 0.20 | 0.22 | 0.26 | 0.23 |
| Hawaiians | 1982 | 0.17 | 0.07 | 0.21 | 0.15 | 0.30 | 0.30 | 0.46 | 0.35 | 0.12 | 0.24 | 0.30 | 0.22 | 0.20 | 0.20 | 0.32 | 0.24 |
| | 1983 | 0.15 | 0.04 | 0.25 | 0.15 | 0.29 | 0.33 | 0.48 | 0.37 | 0.04 | 0.21 | 0.33 | 0.19 | 0.16 | 0.19 | 0.35 | 0.24 |
| | '82 & '83 | 0.16 | 0.06 | 0.23 | 0.15 | 0.30 | 0.31 | 0.47 | 0.36 | 0.08 | 0.22 | 0.32 | 0.21 | 0.18 | 0.20 | 0.34 | 0.24 |
| Japanese | 1982 | 0.10 | 0.00 | 0.14 | 0.07 | 0.27 | 0.24 | 0.32 | 0.28 | 0.01 | 0.15 | 0.25 | 0.14 | 0.13 | 0.13 | 0.23 | 0.16 |
| | 1983 | 0.07 | 0.11 | 0.15 | 0.11 | 0.20 | 0.34 | 0.33 | 0.29 | 0.07 | 0.22 | 0.25 | 0.18 | 0.11 | 0.22 | 0.24 | 0.19 |
| | '82 & '83 | 0.08 | 0.05 | 0.14 | 0.09 | 0.24 | 0.29 | 0.32 | 0.28 | 0.04 | 0.18 | 0.25 | 0.16 | 0.12 | 0.18 | 0.24 | 0.18 |
| All four groups | 1982 | 0.07 | 0.04 | 0.12 | 0.08 | 0.21 | 0.26 | 0.31 | 0.26 | 0.02 | 0.16 | 0.19 | 0.12 | 0.10 | 0.15 | 0.21 | 0.15 |
| | 1983 | 0.14 | 0.03 | 0.15 | 0.11 | 0.24 | 0.27 | 0.34 | 0.28 | 0.05 | 0.16 | 0.22 | 0.14 | 0.14 | 0.15 | 0.23 | 0.18 |
| | '82 & '83 | 0.11 | 0.03 | 0.13 | 0.09 | 0.23 | 0.26 | 0.33 | 0.27 | 0.03 | 0.16 | 0.21 | 0.13 | 0.12 | 0.15 | 0.22 | 0.16 |

[a] Difference = $(\text{mean}_{\text{girls}} - \text{mean}_{\text{boys}}) \div \text{standard deviation}_{\text{girls and boys combined}}$

Table 9
Percent of Hawaii Boys and Girls Performing Above Average on Three Mathematics Subtests, 1982-83 and 1983-84 Combined, by Grade[a]

| Grade | Sex | Stanford Achievement Test mathematics subtest | | | |
|---|---|---|---|---|---|
| | | Applications | Computation | Concepts | Mathematics |
| 4 | Girls | 53.0 | 56.0 | 51.0 | ---- |
| | Boys | 47.0 | 44.0 | 49.0 | ---- |
| 6 | Girls | 51.0 | 57.0 | 54.0 | ---- |
| | Boys | 49.0 | 43.0 | 46.0 | ---- |
| 8 | Girls | 53.5 | 59.0 | 55.5 | ---- |
| | Boys | 46.5 | 41.0 | 44.5 | ---- |
| 10 | Girls | ---- | ---- | ---- | 57.0 |
| | Boys | ---- | ---- | ---- | 43.0 |

[a]Percents above average were calculated using Rosenthal and Rubin's (1982) binomial-effect-size-display method

Table 10

Differences in Percents of Hawaii Boys and Girls in Deciles on Three Mathematics Subtests, 1982-83, by Grade and Ethnic Group*

| Grade | Ethnic group | Stanford Achievement Test subtest, by decile | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Math Applications | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4 | Caucasian | 3.6 (B) | 2.4 (B) | 1.0 (G) | 3.5 (G) | 0.1 (G) | 1.5 (G) | 1.0 (G) | 0.4 (G) | 1.1 (B) | 2.3 (B) |
| | Filipino | 5.1 (B) | 4.1 (B) | 0.6 (B) | 2.7 (B) | 0.3 (G) | 3.3 (G) | 1.9 (G) | 1.6 (G) | 0.3 (G) | 0.5 (G) |
| | Hawaiian | 6.4 (B) | 1.2 (B) | 0.8 (B) | 1.1 (G) | 1.3 (G) | 1.2 (G) | 3.0 (G) | 2.1 (G) | 0.5 (G) | 0.9 (G) |
| | Japanese | 1.4 (B) | 1.1 (B) | 0.4 (B) | 0.4 (G) | 0.3 (G) | 0.8 (G) | 0.6 (G) | 1.4 (G) | 2.2 (G) | 0.6 (G) |
| | All four groups | 4.1 (B) | 3.2 (B) | 0.1 (B) | 2.7 (G) | 0.4 (G) | 1.3 (G) | 1.6 (G) | 1.3 (G) | 0.3 (G) | 0.7 (B) |
| 6 | Caucasian | 1.2 (B) | 0.1 (G) | 0.9 (B) | 0.2 (G) | 0.4 (G) | 3.1 (G) | 1.0 (G) | 0.0 (G) | 1.0 (G) | 2.7 (B) |
| | Filipino | 0.1 (B) | 3.6 (B) | 2.6 (B) | 1.3 (B) | 1.1 (B) | 0.4 (B) | 1.3 (G) | 3.9 (G) | 0.9 (G) | 0.7 (G) |
| | Hawaiian | 1.3 (B) | 1.1 (B) | 4.3 (B) | 0.7 (B) | 1.1 (B) | 0.2 (B) | 2.2 (G) | 0.4 (G) | 1.3 (G) | 0.1 (G) |
| | Japanese | 0.7 (B) | 0.4 (B) | 0.4 (B) | 1.0 (B) | 1.1 (G) | 0.9 (G) | 0.8 (G) | 2.7 (G) | 0.2 (G) | 0.9 (B) |
| | All four groups | 0.5 (B) | 0.4 (B) | 2.0 (B) | 0.0 (B) | 0.9 (G) | 0.7 (B) | 1.2 (G) | 1.7 (G) | 0.3 (G) | 0.8 (B) |
| 8 | Caucasian | 3.3 (B) | 0.0 --- | 0.6 (G) | 2.4 (B) | 0.1 (G) | 1.0 (B) | 1.3 (B) | 0.0 (B) | 0.6 (G) | 0.1 (C) |
| | Filipino | 3.0 (B) | 1.7 (B) | 2.3 (B) | 0.3 (B) | 1.2 (G) | 2.7 (G) | 0.6 (G) | 2.0 (G) | 1.0 (G) | 0.7 (G) |
| | Hawaiian | 7.2 (B) | 3.3 (B) | 1.0 (B) | 3.4 (B) | 4.3 (G) | 0.8 (G) | 0.4 (G) | 1.9 (G) | 1.3 (G) | 0.6 (G) |
| | Japanese | 1.0 (B) | 2.1 (B) | 1.3 (B) | 0.6 (B) | 1.9 (G) | 1.0 (G) | 1.9 (G) | 1.3 (G) | 0.3 (G) | 0.6 (G) |
| | All four groups | 3.0 (B) | 1.0 (B) | 1.0 (B) | 1.3 (B) | 0.9 (G) | 1.5 (G) | 0.2 (G) | 1.2 (G) | 1.0 (G) | 1.0 (G) |
| 10 | Caucasian | 2.7 (B) | 1.3 (B) | 0.1 (B) | 1.2 (B) | 0.7 (B) | 4.2 (G) | 1.0 (G) | 2.1 (G) | 1.7 (B) | 0.4 (G) |
| | Filipino | 7.1 (B) | 3.0 (B) | 4.5 (B) | 3.0 (B) | 1.0 (B) | 4.9 (G) | 3.0 (G) | 1.3 (G) | 1.0 (B) | 1.1 (G) |
| | Hawaiian | 11.0 (B) | 2.7 (B) | 0.9 (B) | 1.5 (G) | 2.7 (G) | 2.5 (G) | 3.3 (G) | 3.0 (G) | 0.1 (G) | 1.5 (G) |
| | Japanese | 1.0 (B) | 1.4 (B) | 1.0 (B) | 1.7 (G) | 0.5 (G) | 1.0 (G) | 1.9 (G) | 0.1 (G) | 1.6 (G) | 2.7 (G) |
| | All four groups | 5.7 (B) | 2.4 (B) | 1.9 (B) | 0.1 (G) | 0.7 (G) | 3.0 (G) | 2.5 (G) | 1.3 (G) | 0.6 (G) | 1.8 (G) |

| Grade | Ethnic group | Stanford Achievement Test subtest, by decile | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Math Computation | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4 | Caucasian | 4.4 (B) | 0.5 (G) | 0.7 (G) | 0.1 (B) | 0.8 (G) | 1.7 (B) | 1.2 (G) | 0.8 --- | 2.5 (G) | 0.4 (G) |
| | Filipino | 3.4 (B) | 2.2 (B) | 1.9 (B) | 3.2 (B) | 1.1 (B) | 1.3 (B) | 3.7 (G) | 0.2 (B) | 4.0 (G) | 3.4 (G) |
| | Hawaiian | 5.9 (B) | 5.9 (B) | 2.6 (B) | 2.9 (G) | 0.6 (B) | 2.7 (G) | 3.7 (G) | 1.0 (B) | 2.3 (G) | 2.5 (G) |
| | Japanese | 3.2 (B) | 3.0 (B) | 3.1 (B) | 0.5 (G) | 2.2 (B) | 0.5 (G) | 2.4 (G) | 0.1 (G) | 1.9 (G) | 10.0 (G) |
| | All four groups | 6.3 (B) | 2.5 (B) | 1.6 (B) | 0.9 --- | 0.5 (B) | 0.4 (G) | 2.4 (G) | 0.4 (G) | 1.8 (G) | 3.7 (G) |
| 6 | Caucasian | 3.8 (B) | 2.2 (B) | 1.6 (B) | 1.9 (G) | 0.0 --- | 0.3 (G) | 0.7 (G) | 0.9 (G) | 4.3 (B) | 0.4 (B) |
| | Filipino | 5.8 (B) | 6.2 (B) | 1.8 (B) | 1.9 (B) | 1.5 (B) | 3.3 (G) | 3.6 (G) | 1.8 (G) | 7.3 (B) | 2.1 (B) |
| | Hawaiian | 6.2 (B) | 5.0 (B) | 2.1 (B) | 0.6 (B) | 0.6 (B) | 0.6 (G) | 2.0 (G) | 0.0 (G) | 2.0 (B) | 1.0 (G) |
| | Japanese | 1.6 (B) | 1.8 (B) | 2.6 (B) | 1.6 (B) | 1.6 (B) | 2.6 (G) | 1.8 (G) | 0.3 (G) | 6.8 (B) | 4.3 (G) |
| | All four groups | 4.4 (B) | 3.9 (B) | 2.1 (B) | 0.4 (B) | 0.9 (B) | 1.5 (G) | 1.8 (G) | 1.6 (G) | 4.9 (B) | 1.9 (G) |
| 8 | Caucasian | 5.0 (B) | 4.7 (B) | 0.7 (B) | 0.6 (B) | 0.7 (B) | 3.7 (G) | 2.4 (G) | 4.5 (G) | 1.3 (G) | 0.1 (B) |
| | Filipino | 3.9 (B) | 5.1 (B) | 4.1 (B) | 2.7 (B) | 1.4 (G) | 2.3 (G) | 3.2 (G) | 1.6 (G) | 5.6 (G) | 4.3 (G) |
| | Hawaiian | 11.0 (B) | 6.9 (B) | 2.3 (B) | 1.6 (B) | 0.9 (G) | 5.0 (G) | 4.6 (G) | 4.0 (G) | 1.9 (G) | 2.8 (G) |
| | Japanese | 3.6 (B) | 1.9 (B) | 1.4 (B) | 1.4 (B) | 1.2 (B) | 1.9 (G) | 0.4 (G) | 0.0 (G) | 0.4 (G) | 18.5 (G) |
| | All four groups | 6.5 (B) | 4.6 (B) | 2.1 (B) | 0.8 (B) | 0.1 (G) | 2.3 (G) | 2.4 (G) | 2.6 (G) | 2.3 (G) | 4.5 (G) |
| 10 | Caucasian | 4.2 (B) | 2.3 (B) | 1.3 (B) | 0.8 (B) | 0.6 (G) | 1.2 (G) | 0.9 (G) | 1.7 (G) | 0.2 (G) | 9.4 (G) |
| | Filipino | 7.8 (B) | 3.0 (B) | 0.5 (B) | 1.9 (B) | 2.9 (G) | 3.2 (G) | 0.1 (G) | 2.2 (G) | 3.4 (G) | 3.4 (G) |
| | Hawaiian | 3.0 (B) | 0.0 (B) | 1.9 (B) | 1.6 (B) | 1.4 (G) | 1.9 (G) | 0.1 (G) | 4.4 (G) | 2.3 (G) | 1.3 (G) |
| | Japanese | 0.8 (B) | 2.4 (B) | 0.5 (B) | 1.7 (G) | 1.8 (G) | 1.2 (G) | 0.5 (G) | 0.9 (G) | 1.7 (G) | 9.4 (G) |
| | All four groups | 0.4 (B) | 3.5 (B) | 0.2 (B) | 0.2 (G) | 0.7 (G) | 0.7 (G) | 0.3 (G) | 1.3 (G) | 0.1 (G) | 1.9 (B) |

| Grade | Ethnic group | Stanford Achievement Test subtest, by decile | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Math Concepts | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4 | Caucasian | 8.0 --- | 0.6 (G) | 1.0 (G) | 1.4 (G) | 0.9 (G) | 1.5 (G) | 0.5 (G) | 2.2 (B) | 1.6 (B) | 3.0 (B) |
| | Filipino | 0.9 (G) | 2.9 (B) | 3.1 (B) | 0.5 (G) | 2.2 (B) | 0.7 (B) | 0.6 (G) | 4.2 (G) | 0.1 (B) | 1.6 (G) |
| | Hawaiian | 1.9 (B) | 1.7 (B) | 0.4 (B) | 2.7 (G) | 1.2 (B) | 0.6 (G) | 0.6 (B) | 0.6 (G) | 1.1 (G) | 9.4 (B) |
| | Japanese | 0.8 (B) | 2.4 (B) | 0.5 (B) | 1.7 (G) | 1.0 (G) | 1.0 (G) | 1.2 (B) | 0.5 (G) | 0.9 (G) | 1.7 (B) |
| | All four groups | 0.4 (B) | 3.5 (B) | 0.2 (B) | 0.2 (G) | 0.7 (G) | 0.7 (G) | 0.3 (G) | 1.3 (G) | 0.1 (B) | 1.9 (B) |
| 6 | Caucasian | 0.3 (B) | 1.1 (B) | 0.9 (B) | 0.5 (G) | 1.2 (B) | 0.9 (B) | 0.4 (G) | 1.1 (G) | 2.6 (G) | 1.5 (B) |
| | Filipino | 2.6 (B) | 4.5 (B) | 2.3 (B) | 1.0 (G) | 2.1 (B) | 1.3 (B) | 0.9 (G) | 2.4 (G) | 2.3 (G) | 3.5 (G) |
| | Hawaiian | 7.1 (B) | 3.9 (B) | 0.8 (B) | 1.9 (G) | 2.1 (B) | 0.3 (B) | 1.3 (G) | 3.0 (G) | 3.3 (G) | 0.6 (B) |
| | Japanese | 0.3 (B) | 1.6 (B) | 1.0 (B) | 0.8 (G) | 1.5 (B) | 2.3 (B) | 2.4 (G) | 0.6 (G) | 3.7 (G) | 1.9 (G) |
| | All four groups | 2.6 (B) | 2.7 (B) | 1.4 (B) | 0.6 (G) | 0.7 (B) | 0.9 --- | 1.3 (G) | 1.8 (G) | 3.0 (G) | 0.7 (G) |
| 8 | Caucasian | 3.6 (B) | 1.7 (B) | 1.1 (G) | 0.2 (B) | 1.7 (G) | 0.9 (B) | 2.5 (B) | 3.6 (G) | 0.9 (G) | 6.3 (B) |
| | Filipino | 4.5 (B) | 3.0 (B) | 4.1 (B) | 0.1 (G) | 1.7 (B) | 1.4 (G) | 3.7 (G) | 0.1 (G) | 2.2 (G) | 3.4 (G) |
| | Hawaiian | 7.8 (B) | 3.0 (B) | 0.5 (B) | 1.9 (G) | 2.9 (B) | 3.2 (G) | 0.1 (G) | 4.4 (G) | 2.3 (G) | 1.3 (G) |
| | Japanese | 2.0 (B) | 0.0 (B) | 1.9 (B) | 1.6 (G) | 1.4 (B) | 1.9 (G) | 0.3 (G) | 0.9 (G) | 1.3 (G) | 9.1 (G) |
| | All four groups | 4.2 (B) | 2.3 (B) | 1.3 (B) | 0.0 (G) | 1.2 (B) | 3.7 (G) | 0.2 (G) | 1.6 (G) | 1.5 (G) | 3.4 (G) |
| 10 | Caucasian | 2.7 (B) | 1.3 (B) | 0.1 (B) | 1.2 (B) | 0.7 (B) | 4.2 (G) | 1.0 (G) | 2.1 (G) | 1.7 (B) | 0.4 (G) |
| | Filipino | 7.1 (B) | 3.0 (B) | 4.5 (B) | 3.0 (B) | 1.0 (B) | 4.9 (G) | 3.0 (G) | 1.3 (G) | 1.0 (B) | 1.1 (G) |
| | Hawaiian | 11.0 (B) | 2.7 (B) | 0.9 (B) | 1.5 (G) | 2.7 (G) | 2.5 (G) | 3.3 (G) | 3.0 (G) | 0.1 (G) | 1.5 (G) |
| | Japanese | 1.0 (B) | 1.4 (B) | 1.0 (B) | 1.7 (G) | 0.5 (G) | 1.0 (G) | 1.9 (G) | 0.1 (G) | 1.6 (G) | 2.7 (G) |
| | All four groups | 5.7 (B) | 2.4 (B) | 1.9 (B) | 0.1 (G) | 0.7 (G) | 3.0 (G) | 2.5 (G) | 1.3 (G) | 0.6 (G) | 1.8 (G) |

*Letters in parentheses show the sex (B = boys and G = girls) with the higher percent in a decile.





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Table 11
Differences in Percents of Hawaii Boys and Girls in Deciles on Three Mathematics Subtests, 1983-84, by Grade and Ethnic Group[a]

| Grade | Ethnic group | Stanford Achievement Test subtest, by decile | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Math Applications | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4 | Caucasian | 2.6 (B) | 2.1 (B) | 1.4 (G) | 0.4 (G) | 0.6 (G) | 0.3 (G) | 0.1 (G) | 1.4 (G) | 2.8 (G) | 1.3 (B) |
| | Filipino | 6.8 (B) | 3.2 (B) | 0.6 (B) | 2.8 (G) | 1.8 (G) | 0.8 (G) | 2.4 (G) | 0.3 (B) | 1.7 (G) | 1.3 (G) |
| | Hawaiian | 5.7 (B) | 1.9 (B) | 0.7 (B) | 1.0 (G) | 3.4 (B) | 0.1 (G) | 2.5 (G) | 1.3 (G) | 1.1 (B) | 1.0 (G) |
| | Japanese | 0.8 (B) | 1.2 (B) | 0.5 (G) | 0.3 (B) | 1.5 (B) | 0.4 (G) | 1.0 (G) | 1.6 (G) | 0.3 (G) | 0.2 (G) |
| | All four groups | 4.5 (B) | 2.3 (B) | 0.1 (G) | 0.9 (G) | 1.2 (G) | 0.4 (G) | 1.5 (G) | 1.1 (G) | 1.1 (G) | 0.5 (G) |
| 6 | Caucasian | 1.1 (G) | 0.7 (B) | 0.0 --- | 2.1 (B) | 0.6 (G) | 2.0 (G) | 0.1 (G) | 0.9 (G) | 0.8 (B) | 1.3 (B) |
| | Filipino | 1.1 (B) | 1.5 (B) | 0.6 (B) | 0.1 (G) | 0.3 (G) | 0.4 (G) | 3.9 (G) | 0.1 (G) | 0.3 (G) | 1.9 (B) |
| | Hawaiian | 0.9 (G) | 1.2 (B) | 1.8 (B) | 3.0 (B) | 1.2 (G) | 2.3 (G) | 1.7 (G) | 0.2 (C) | 0.5 (G) | 0.7 (B) |
| | Japanese | 1.4 (B) | 0.2 (B) | 2.6 (B) | 0.6 (B) | 1.5 (B) | 1.8 (G) | 0.5 (G) | 1.9 (G) | 2.6 (G) | 0.5 (B) |
| | All four groups | 0.0 --- | 0.9 (B) | 1.1 (B) | 1.4 (B) | 0.2 (C) | 1.6 (G) | 1.5 (G) | 0.7 (G) | 0.5 (G) | 1.2 (B) |
| 8 | Caucasian | 1.2 (B) | 2.4 (B) | 1.8 (B) | 0.3 (C) | 3.1 (G) | 0.4 (G) | 1.5 (G) | 1.0 (G) | 1.2 (B) | 0.3 (G) |
| | Filipino | 4.4 (B) | 1.3 (B) | 2.4 (B) | 0.3 (B) | 0.3 (G) | 1.5 (C) | 1.9 (G) | 2.2 (G) | 0.8 (G) | 1.8 (G) |
| | Hawaiian | 5.4 (B) | 3.9 (B) | 3.1 (B) | 1.5 (C) | 0.7 (G) | 1.6 (G) | 4.0 (G) | 2.7 (G) | 1.5 (G) | 0.3 (G) |
| | Japanese | 1.4 (B) | 1.0 (B) | 1.4 (B) | 2.4 (B) | 1.0 (B) | 0.2 (G) | 1.2 (G) | 3.1 (G) | 0.5 (G) | 2.4 (G) |
| | All four groups | 3.2 (B) | 2.1 (B) | 2.2 (B) | 0.2 (B) | 0.8 (G) | 0.9 (G) | 2.2 (G) | 2.2 (G) | 0.4 (G) | 1.2 (G) |
| 10 | | Mathematics Subtest | | | | | | | | | |
| | Caucasian | 5.4 (B) | 1.7 (B) | 2.5 (B) | 0.7 (C) | 0.7 (G) | 5.1 (G) | 4.0 (G) | 1.8 (G) | 0.1 (G) | 2.9 (B) |
| | Filipino | 6.7 (B) | 4.7 (B) | 2.1 (B) | 1.4 (B) | 1.0 (B) | 0.3 (G) | 7.4 (G) | 3.4 (G) | 3.7 (G) | 1.1 (G) |
| | Hawaiian | 11.8 (B) | 4.5 (B) | 0.0 --- | 2.6 (G) | 1.9 (G) | 3.6 (G) | 3.5 (G) | 1.9 (G) | 2.3 (G) | 0.6 (G) |
| | Japanese | 2.4 (B) | 2.7 (B) | 2.3 (B) | 1.2 (B) | 2.8 (B) | 1.1 (G) | 1.1 (G) | 3.7 (G) | 0.2 (G) | 5.2 (G) |
| | All four groups | 6.6 (B) | 3.5 (B) | 1.8 (B) | 0.1 (B) | 0.4 (B) | 2.3 (G) | 4.1 (G) | 2.9 (G) | 1.8 (G) | 1.4 (G) |

| Grade | Ethnic group | Stanford Achievement Test subtest, by decile | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Math Computation | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4 | Caucasian | 2.4 (B) | 2.0 (B) | 2.4 (B) | 0.9 (G) | 0.1 (B) | 0.1 (B) | 0.2 (G) | 1.2 (G) | 2.8 (G) | 1.6 (G) |
| | Filipino | 5.1 (B) | 3.4 (B) | 4.6 (B) | 3.0 (B) | 2.0 (G) | 0.5 (C) | 1.5 (G) | 4.9 (G) | 3.0 (G) | 4.3 (G) |
| | Hawaiian | 5.8 (B) | 4.5 (B) | 2.3 (B) | 0.2 (C) | 1.6 (G) | 2.6 (G) | 0.4 (B) | 3.0 (G) | 1.8 (G) | 4.0 (G) |
| | Japanese | 0.1 (B) | 0.7 (B) | 3.9 (B) | 2.7 (B) | 1.7 (B) | 1.8 (G) | 0.7 (B) | 0.9 (G) | 0.2 (B) | 7.2 (G) |
| | All four groups | 3.6 (B) | 2.8 (B) | 3.3 (B) | 1.0 (B) | 0.6 (G) | 1.2 (G) | 0.2 (G) | 2.6 (G) | 2.1 (G) | 4.1 (G) |
| 6 | Caucasian | 3.6 (B) | 3.3 (B) | 0.7 (B) | 1.5 (B) | 0.3 (B) | 0.1 (B) | 2.6 (G) | 4.7 (G) | 0.7 (G) | 1.5 (G) |
| | Filipino | 4.9 (B) | 4.0 (B) | 1.4 (B) | 2.3 (B) | 1.0 (B) | 1.1 (C) | 3.0 (G) | 4.7 (G) | 2.2 (G) | 2.7 (G) |
| | Hawaiian | 6.9 (B) | 3.2 (B) | 4.4 (B) | 0.0 --- | 0.5 (G) | 3.0 (G) | 3.2 (G) | 2.8 (G) | 3.5 (G) | 1.7 (G) |
| | Japanese | 3.0 (B) | 4.1 (B) | 2.9 (B) | 2.9 (B) | 0.1 (G) | 0.7 (B) | 1.9 (G) | 0.0 --- | 4.0 (G) | 7.6 (G) |
| | All four groups | 4.6 (B) | 3.6 (B) | 2.3 (B) | 1.6 (B) | 0.2 (B) | 0.9 (C) | 2.7 (G) | 3.1 (G) | 2.5 (G) | 3.1 (G) |
| 8 | Caucasian | 4.8 (B) | 4.0 (B) | 2.2 (B) | 1.9 (B) | 1.4 (G) | 0.7 (G) | 1.5 (G) | 2.7 (G) | 3.0 (G) | 3.6 (G) |
| | Filipino | 6.6 (B) | 6.6 (B) | 1.1 (B) | 1.0 (B) | 1.2 (G) | 2.3 (G) | 1.4 (C) | 4.9 (G) | 3.4 (G) | 4.3 (G) |
| | Hawaiian | 11.1 (B) | 8.7 (B) | 0.6 (B) | 1.4 (B) | 2.5 (G) | 4.8 (G) | 3.9 (G) | 5.8 (G) | 3.2 (G) | 1.6 (G) |
| | Japanese | 2.1 (B) | 3.8 (B) | 2.5 (B) | 2.8 (B) | 0.1 (G) | 2.0 (G) | 1.7 (G) | 4.0 (G) | 2.3 (G) | 8.7 (G) |
| | All four groups | 6.1 (B) | 5.8 (B) | 1.6 (B) | 1.8 (B) | 0.7 (G) | 1.5 (G) | 1.2 (G) | 4.3 (G) | 3.0 (G) | 4.5 (G) |
| 10 | Caucasian | 5.1 (B) | 4.0 (B) | 1.8 (B) | 0.1 (G) | 2.9 (B) | | | | | |
| | Filipino | 7.4 (G) | 3.4 (G) | 3.7 (G) | 1.1 (G) | | | | | | |
| | Hawaiian | 3.5 (G) | 1.9 (G) | 2.3 (G) | 0.6 (G) | | | | | | |
| | Japanese | 1.1 (G) | 3.7 (G) | 0.2 (G) | 5.2 (G) | | | | | | |
| | All four groups | 4.1 (G) | 2.9 (G) | 1.8 (G) | 1.4 (G) | | | | | | |

| Grade | Ethnic group | Stanford Achievement Test subtest, by decile | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Math Concepts | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4 | Caucasian | 0.5 (B) | 0.1 (G) | 0.7 (G) | 0.6 (G) | 3.5 (G) | 0.6 (G) | 0.8 (B) | 0.4 (B) | 0.5 (B) | 2.3 (B) |
| | Filipino | 2.5 (B) | 2.7 (B) | 1.8 (B) | 1.8 (G) | 0.3 (G) | 1.9 (G) | 1.1 (B) | 2.3 (G) | 0.4 (G) | 1.5 (G) |
| | Hawaiian | 0.6 (G) | 1.1 (B) | 3.0 (B) | 1.2 (G) | 0.6 (G) | 1.9 (G) | 1.3 (B) | 1.7 (G) | 0.3 (B) | 0.9 (G) |
| | Japanese | 0.2 (G) | 1.7 (B) | 1.5 (B) | 1.8 (G) | 2.1 (G) | 0.9 (B) | 0.7 (G) | 1.1 (G) | 1.8 (G) | 0.1 (G) |
| | All four groups | 0.7 (B) | 1.4 (B) | 1.5 (B) | 0.5 (G) | 1.6 (G) | 1.0 (G) | 0.7 (B) | 1.2 (G) | 0.3 (G) | 0.2 (G) |
| 6 | Caucasian | 2.0 (B) | 1.6 (B) | 0.7 (B) | 0.5 (B) | 0.7 (G) | 0.6 (G) | 0.7 (G) | 1.2 (G) | 0.4 (B) | 1.8 (B) |
| | Filipino | 3.7 (B) | 1.7 (B) | 2.4 (B) | 1.2 (B) | 1.0 (G) | 0.4 (G) | 0.4 (G) | 0.8 (G) | 1.6 (G) | 2.6 (G) |
| | Hawaiian | 6.6 (B) | 0.2 (B) | 0.2 (B) | 0.8 (B) | 0.1 (B) | 2.1 (B) | 0.1 (B) | 2.4 (G) | 1.2 (G) | 2.0 (G) |
| | Japanese | 2.7 (B) | 3.0 (B) | 1.6 (B) | 0.2 (B) | 0.7 (G) | 2.1 (B) | 1.4 (G) | 3.9 (G) | 1.7 (G) | 3.0 (G) |
| | All four groups | 3.7 (B) | 1.5 (B) | 1.2 (B) | 0.1 (G) | 0.3 (G) | 0.3 (G) | 0.6 (G) | 1.9 (G) | 0.9 (G) | 2.2 (G) |
| 8 | Caucasian | 3.0 (B) | 0.7 (B) | 2.2 (B) | 1.1 (B) | 2.5 (C) | 1.3 (B) | 0.8 (G) | 0.1 (G) | 3.5 (G) | 1.4 (G) |
| | Filipino | 2.6 (B) | 3.0 (B) | 2.1 (B) | 2.2 (B) | 1.5 (B) | 0.7 (G) | 2.6 (G) | 2.7 (G) | 3.0 (G) | 2.3 (G) |
| | Hawaiian | 8.6 (B) | 3.2 (B) | 2.9 (B) | 0.3 (G) | 0.1 (B) | 4.2 (G) | 1.2 (G) | 3.9 (G) | 2.7 (G) | 0.5 (G) |
| | Japanese | 1.8 (B) | 0.9 (B) | 2.4 (B) | 1.9 (B) | 1.9 (B) | 1.3 (G) | 0.2 (G) | 1.9 (G) | 4.7 (G) | 7.3 (G) |
| | All four groups | 4.0 (B) | 1.9 (B) | 2.4 (B) | 0.7 (B) | 1.5 (B) | 1.8 (G) | 1.2 (G) | 1.3 (G) | 3.4 (G) | 2.8 (G) |
| 10 | Caucasian | 0.7 (B) | 1.4 (B) | 0.3 (B) | 0.2 (G) | 1.9 (G) | 4.7 (G) | 7.3 (G) | | | |
| | Filipino | 3.7 (B) | 2.7 (B) | 3.0 (B) | 2.3 (G) | | | | | | |
| | Hawaiian | 2.3 (B) | 3.9 (B) | 2.7 (G) | 0.5 (G) | | | | | | |
| | Japanese | 1.9 (B) | 1.3 (B) | 0.2 (G) | 4.7 (G) | | | | | | |
| | All four groups | 2.4 (B) | 0.7 (B) | 1.5 (B) | 1.8 (G) | 1.2 (G) | 1.3 (G) | 3.4 (G) | | | |

[a] Letters in parentheses show the sex (B = boys and G = girls) with the higher percent in a decile.







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